

HOST INTEGRATION OF PRE-CERTIFIED RADIO MODULES

Keeping your EMI/Wireless testing to a minimum

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The use of pre-certified radio modules by product manufacturers has been growing in popularity. The process of designing a radio transceiver and meeting all the “Country Specific” regulatory requirements through extensive testing and documentation can be a long process. One of the many benefits of using a pre-certified radio module is that it significantly reduces both the cost of development and the time to market. If used in accordance with the module's Grant of Certification and integration instructions, it can limit the EMI/wireless testing to a minimal “spot-check” verification of the radiated emissions with the module installed in the host product. When performing this spot check a certified test lab will only need to focus on the worst-case conditions from the original certification. They will be checking the band edges to ensure the product is not operating out of band and verifying that the harmonics from the transmitter are still compliant.



Testing for radiated emissions in host product at D.L.S. Electronic Systems, Wheeling, IL

While there are several advantages in taking this approach, it is important for manufacturers to understand that using a pre-certified radio module does not exempt them from all responsibilities related to the module. They still must perform due diligence to ensure continued compliance with the module installed in their host product.

Most transmitters, whether Wi-Fi, BT, BLE or any other wireless technology, require certification. Generally, there are two paths of certification for transmitters, “Standard radio” approval or “Modular radio” approval. Standard radio approvals are used when a company designs their product with a transmitter that either was not already certified or uses their own proprietary design. In this case they are certifying the entire product as a radio device and would therefore need to meet all the radio and EMC standards as a complete product. A modular approval is typically used when a radio manufacturer develops a radio module that can be used in many different products. This allows product manufacturers to purchase this “Pre-Certified” radio module and incorporate it into their product assuming they follow specific guidelines for integration. This type of certification has additional requirements than Standard approvals such as shielding over the transmitter circuit and formal voltage regulation of the transmitter circuit.



Pre-certified module with antenna

Although modular certification testing is performed by the radio manufacturer with the module as a stand-alone device, when installed in a host product radiated emissions from the radio module can be influenced by the enclosure, circuit boards and components near the module.

As an example, an electric appliance being tested in our lab was failing the spot check of the radiated spurious emissions coming from the transmitter. We were verifying that the harmonics of the intentional signal were still within limits after being incorporated into a host product. There was a Wi-Fi module installed in the back of the all-metal product causing the antenna to be in close proximity to the metal cabinet. This created reflections that caused the harmonic emissions to be over the limit.

To resolve the issue, we worked with the customer to design several different mounting blocks out of composite plastic material to move the antenna further away from the metal enclosure. We ran several test configurations to determine the size of the antenna spacer that gave the best performance while still meeting the requirements of the standard.

The host device must always be verified for compliance to the radio standards with the module installed because interactions that can change the radiated emissions can occur from the host device to the module and from the module to the host device.



Antenna with the added spacer in a product being tested at D.L.S. Electronic Systems, Inc.

Interactions can occur from the host device to the module and from the module to the host device that can change the radiated emissions.

RADIO MODULE MANUFACTURERS

Radio module manufacturers have several responsibilities to assist a host product manufacturer with the successful and compliant integration of the radio module. They need to ensure that the module meets all aspects of the regulations governing the radio equipment prior to marketing it as a modular device. This includes obtaining full certification of the module with the proper regulating authorities and providing clear integration instructions. These instructions give extensive guidance for the integration of the module into a host device, including:

- Labeling information that must be added to the host device
- Minimum distances that must be maintained between the antenna and the end user
- The list of approved antennas that can be used

The instructions also inform the host manufacturer how to handle cases where the integrator wishes to use the module in a way that does not fit within the module's Grant of Certification or the module manufacturer's integration guidelines. Examples would be using unapproved

antennas or installing the module in a location that does not provide the stated minimum separation distance to an end user or bystander.

The Radio module manufacturer must also provide access to special test software to put the module into the test modes that were used to originally certify the module. They are required to work with the host manufacturer to ensure they have the capability to test for compliance and mitigate any non-conformance issues that are directly related to the radio module.

HOST EQUIPMENT MANUFACTURERS

Host manufacturers should start by checking the Grant of Certification for notes and statements to ensure their plan for integration does not violate any conditions of the grant. They need to read the manufacturer's integration instructions carefully to verify that their intended design follows all the instructions for proper use of the module. Host manufacturers should look at module integration as a system design and consider early design review. The implementation of a module should not be just a hardware selection. Things such as antenna placement, RF exposure requirements and whether there will be multiple radios installed also need to be considered. If the integration instructions cannot be followed, the product will need more extensive level of testing to ensure compliance. Furthermore, they may need to file a Class 2 Permissive change with a TCB to certify the module with whatever deviations are made from the original grant of certification. Once the host manufacturer has integrated the pre-certified module into their product, they are responsible for that module and must ensure their product remains compliant with all the applicable wireless and EMC standards.

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This is achieved by reviewing the module's certification test reports and looking for the test configurations that were shown to be worst-case with respect to the radiated emission limits. Those worst-case configurations are used to develop a test plan to verify compliance of the radio module after it has been installed in the host product. Most importantly, the host manufacturer needs to work with the module manufacturer to put the module into these test modes so they can assure compliance through an independent test lab.

For guidance on how to integrate a pre-certified radio module into a host device we recommend the following documents:

For products intended to be sold in the United States, see the FCC's *Modular Transmitter Integration Guide: Guidance for host product manufacturers* (FCC KDB 996369 D04 Module Integration Guide v02) <https://apps.fcc.gov/oetcf/kdb/index.cfm>

For products intended to be sold in Canada, see *RSP-100 Issue 12: Certification of Radio Apparatus and Broadcasting Equipment*, Section 8: Host/modular product requirements <https://ISED-ISDE.CANADA.CA/site/spectrum-management-telecommunications/en/devices-and-equipment/radio-standards-procedures-rsp/rsp-100-certification-radio-apparatus-and-broadcasting-equipment>

For products intended to be sold in Europe, see *REDCA Technical Guidance Note 01 (REDCA TGN 01 V1.2a): RED compliance requirements for Radio Equipment often referred to as Radio Module and the Final Radio Equipment Product that integrates a Radio Module* <https://redca.eu/Pages/Documents1.htm#4>

For assistance with developing a verification test plan for the required testing, check with your third-party test lab or contact Jack Black at jblack@dlsemc.com.

It is important to bring the following items to the test lab:

- the radio module's Grant of Certification
- the radio module's integration instructions
- the radio module's test reports
- special firmware provided by the module manufacturer

Summary

While there are many benefits to using a pre-certified radio module such as reducing the cost of development and the time to market, there are several important aspects to this process that need to be considered. The module's Grant of Certification and integration instructions should be followed very closely to ensure the product remains compliant. Failure to do so may require additional testing or recertification of the module in some capacity. The host manufacturer must obtain the firmware needed from the module manufacturer to place the module into the proper test modes. They will then work with the test lab to determine the worst-case test modes so they can verify the module is still compliant after it has been installed in the Host device. The Host product manufacturer needs to understand that even though the module was already certified, once they incorporate it into their product they assume all liability for continued compliance.

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